(6.6) Solving Problems Using Quadratic Equations

The **solutions** to a quadratic equation are called the **roots** or **zeros** or **x-intercepts.**

To find the solution/zeros the quadratic equation must equal zero. Then, factor to find the zeros.

**Example 1:** Solve .

**Example 2:** Solve .

**Example 3:** Mike hits a golf ball upwards from the top of a cliff. The height of the ball above the base of the cliff is approximated by the model , where  is height in metres and  is time in seconds.

1. How high is the cliff?
2. How long does it take for the ball to reach a height of 42 m?
3. How long does it take for the ball to reach the ground?
4. What is the maximum height of the ball?
5. How long is the ball above a height of 90 m?
6. A baseball is hit and its height is given by the relation , where  is the height in metres and  is the time in seconds.
7. What is the maximum height reached by the ball? **[20 m]**
8. When does the ball reach its maximum height? **[2 s]**
9. How long is it in the air? **[4 s]**
10. Greg is tossing pine cones from the side of an old quarry. The pine cones fall into the water-filled hole below. The height, , in metres of the pine cone above the surface of the water is approximately given by , where  is time in seconds since Greg tossed the pine cone.
11. How long did it take for the pine cone to hit the water? **[4 s]**
12. How high is Greg standing from the water? **[20 m]**
13. What is the height of the pine cone after 1.5 seconds? **[31.25 m]**
14. A computer software company models the profit on its latest game using the relation , where  is the number of games it produces in hundred thousands and  is the profit in millions of dollars.
15. What is the maximum profit the company can earn? **[$32,000,000]**
16. How many games must it produce to earn this profit? **[700,000]**
17. The company breaks even when there is neither a profit nor a loss (profit = 0). What are the break-even points for the company? **[300,000 & 1,100,000 games]**
18. A model rocket is shot straight up from the roof of the school. The height at any time is approximated by the model , where  is the height in metres and  is the time in seconds.
19. What is the height of the school? **[25 m]**
20. How long is the rocket above a height of 40 m? **[2 s]**
21. When does the rocket hit the ground? **[5 s]**
22. What is the maximum height of the rocket? **[45 m]**
23. The Wheely Fast Co. Makes custom skateboards for professional riders. They model their profit with the function , where  is the number of skateboards they produce, in thousands, and  is the company’s profit in hundreds of thousands of dollars.
24. At what production level(s) does Wheely Fast Break even? **[2,000 & 5,000 skateboards]**
25. How many skateboards does Wheely Fast need to produce to maximize profit? **[3,500]**
26. Farmer Brown determines that the expression  models the area of a rectangular garden, whererepresents area in square metres and represents the width of the garden in metres. What dimensions produce and area of ? **[10 m by 18 m; 6 m by 30 m]**
27. Fashion Fun Company determined that the relation  modelled expected revenue for Sacred Heart sweat pants.  is revenue in dollars, and  is the amount of the change in price. Determine the change in price that will result in revenue of $126. **[increase of $2 ; decrease of $2]**
28. A pair of skydivers jump out of an airplane 5.5 km above the ground. The relation  is an approximate model for the divers’ altitude in metres at  seconds after jumping out of the plane.
29. After 10 s how far have the divers fallen? **[500 m]**
30. They open their chutes at an altitude of 1000 m. How long did they free-fall? **[30 s]**